

JPL's Enterprise Information System Architecture

Summary of Recommendations

Steve Jenkins

5/22/96

Agenda

- ◆ EIS Architecture Team charter and process
- ◆ EIS Architecture
 - Overview
 - Infrastructure Service Recommendations
 - Example Value-Added Services
- ◆ This is a *technical* overview
 - many organizational questions in process

EISAT Charter

- ◆ Charter 6/12/95 by: Rick Green (EPIC), Jim Minges (111S), Tom Thornton (ICIS)
- ◆ Concurrence: John Casani (500), Chris Carl (390)
- ◆ Assignment: produce a recommended architecture for JPL's Enterprise Information System (technical and business)

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EISAT Process

- ◆ Assemble team
 - Chosen for knowledge of problem domain and information technology
 - Team: José Amoedo (35), Chris Eddington (31), Joe Kahr (39), Peter Shames (38), Bob Somer (22)
- ◆ Examine, evaluate, and recommend best industry practice

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Getting The Document

- ◆ Paper: JPL D-12991, Vellum Files
- ◆ PostScript, PDF:
<http://epic.jpl.nasa.gov/afs/jpl/group/eisat/www>
 - PDF is imperfect (some pages were scanned in)
- ◆ Comments to the team:
<mailto:eisat@snapon.jpl.nasa.gov>
 - at least one revision will be published

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Architecture Overview

- ◆ Concepts and Principles
 - Foundation assumptions and facts
- ◆ Infrastructure Services
 - Application-independent enabling services upon which others are built
- ◆ Example Value-Added Services
 - JPL-specific services that meet mission-critical process requirements

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Guiding Principles 1

- ◆ Architecture provides a framework for efficient implementation of information systems
- ◆ Information resources are institutional assets, and are managed accordingly
- ◆ Vendor-neutral standards, heterogeneous systems are assumed

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Guiding Principles 2

- ◆ Enterprise information system is effective, feasible, manageable, reliable, secure, extensible, scalable, flexible
- ◆ Enterprise information system reflects best industry practice
- ◆ Principles elaborated in detail in D-12991, Appendix A

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Basis for Recommendations

- ◆ Meets service requirements
 - including cross-service integration
- ◆ Governed by open specifications
- ◆ Subject of industry consensus
- ◆ Commercially available
- ◆ Successfully deployed in industry

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An Aside on DCE 1

- ◆ Several service recommendations are based on OSF DCE
- ◆ Driving requirements:
 - cross-service integration, especially security, directory, and remote procedure call
 - integration with external directory and security domains
 - RPC interface version control

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An Aside on DCE 2

- ◆ Open specifications: DCE specifications published by X/Open
- ◆ industry consensus: vendor commitments from Cray, Digital, HP, IBM, Microsoft, SGI, SunSoft, others
- ◆ Available on AIX, Digital Unix, I[IP-UX, IRIX, OS/2, Solaris, SunOS, Unicos, VMS, Windows (3.1, 95, N-I), MacOS (96)

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An Aside on DCE 3

- ◆ Successful deployments: United Healthcare, Phillips Petroleum, General Motors, US West Communications, Barclays Bank, SECOM Information Systems, Tokio Marine and Fire Insurance, I[XIS NEXIS, US Army, Motorola, MCI, Bell Atlantic, Bell Northern, Hughes Information Systems

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Infrastructure Services

- ◆ Communication: network, remote procedure call
- ◆ Distribution: object, directory, time sync, security, systems management
- ◆ Application: file, messaging, transaction processing, data access, windowing, data interchange
- ◆ Development Support: framework

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Infrastructure Services: Communication

Network Service

- ◆ Service: Basic communication service upon which other services are built
- ◆ Recommendation: TCP/IP, universal connectivity (on-lab, off-lab)
- ◆ Status: Implementation under way in HiNet task (ICIS), complete FY96
 - some enhancements recommended (e.g., client software support)

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Infrastructure Services: Communication

Remote Procedure Call Service

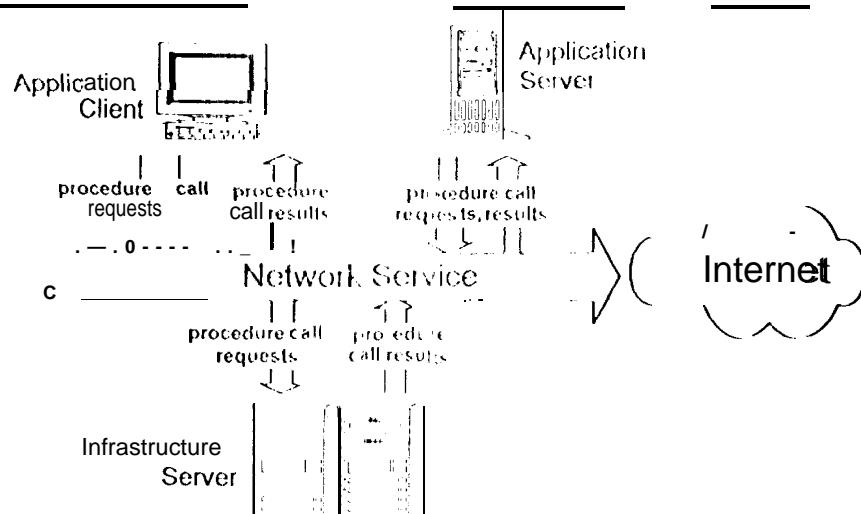
- ◆ Service: Recommended practices and software for low-level program-to-program communication
- ◆ Recommendation: OSF [Distributed Computing Environment (DCE)]
- ◆ Status: Implementation under way in CAE Project (EPIC), development complete FY96

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Infrastructure Services: Communication

Remote Procedure Call Set-view



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Infrastructure Services: Distribution

Object Service

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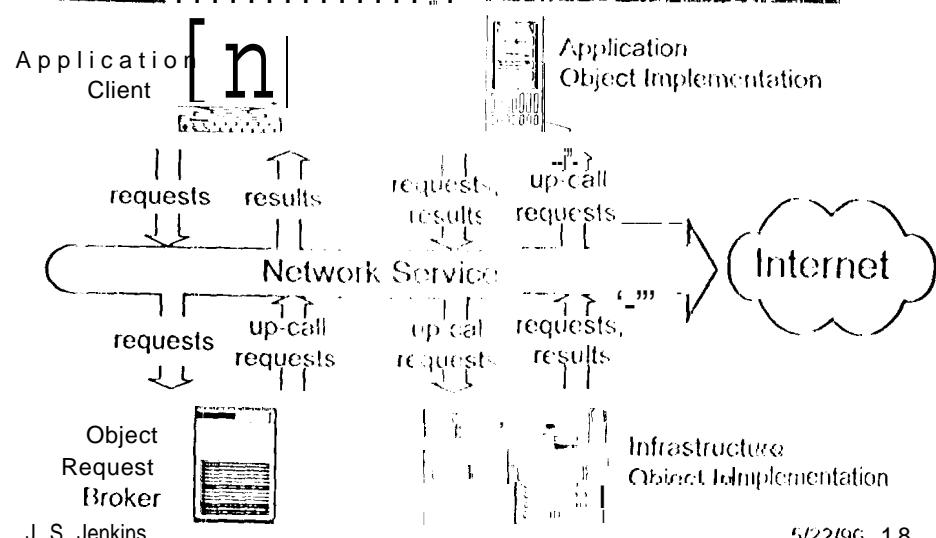
- ◆ **Service:** Provides support infrastructure for deploying object-oriented applications
- ◆ **Recommendation:** None; no industry consensus on object strategy
- ◆ **Status:** Prototyping/evaluation under way in several tasks (e.g., DSN Information Systems Engineering lab)

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Infrastructure Services: Distribution

Object Service



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Infrastructure Services: Distribution

Directory Service

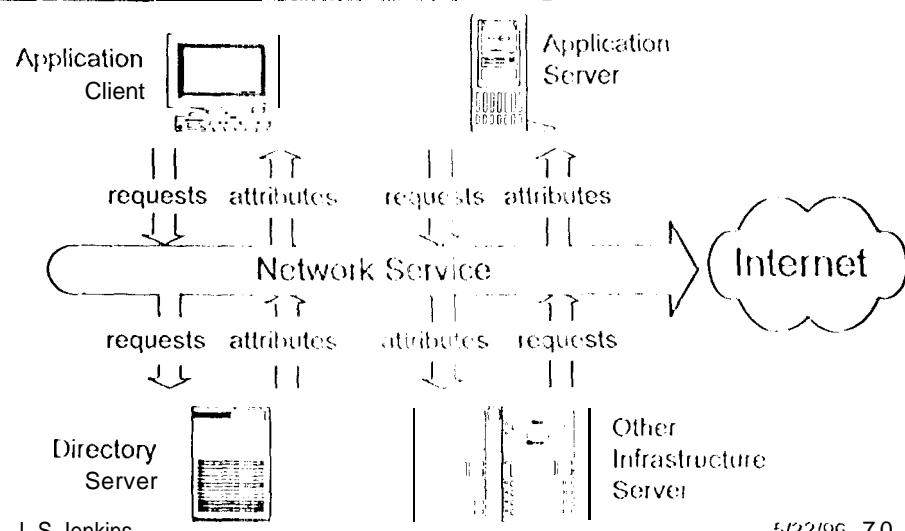
- ◆ Service: Runtime lookup/location service for network resources: people, computers, servers, printers, etc.
- ◆ Recommendation: OSF DCE, X.500
- ◆ Status: X.500 operational (ICIS), DCE under way in CAF Project (EPIC), development complete FY96
 - significant integration work required

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Infrastructure Service Example

Directory Service



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Infrastructure Services: I distribution

Time Synchronization Service

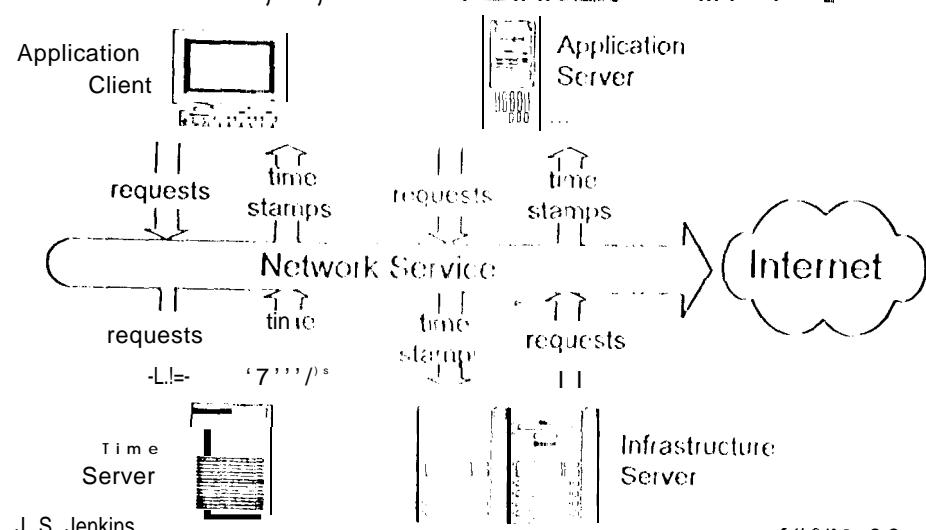
- ◆ Service: Utility service for keeping computer clocks synchronized to UTC
- ◆ Recommendation: OSF DCE, Internet NTP
- ◆ Status: NTP service operational (ICIS), DCE under way in CAE (EPIC), development complete FY96
 - significant integration work required

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Infrastructure Services - Distribution

Time Synchronization Service



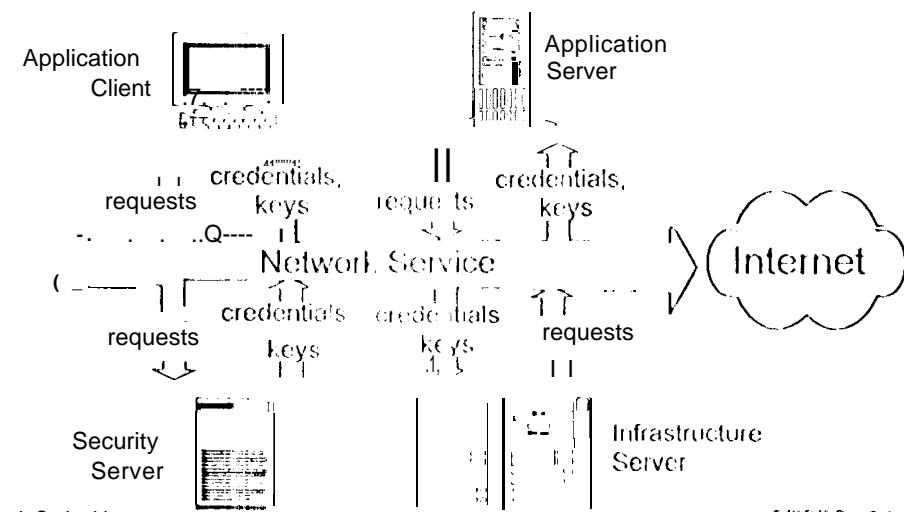
Infrastructure Services Distribution **Security Service**

- ◆ **Service:** Enables authentication, authorization, integrity, and privacy for other services
- ◆ **Recommendation:** OSF DCE, Kerberos V5, Internet GSS-API
- ◆ **Status:** Underway in CAE (EPIC), development complete FY96
 - major integration work required

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Infrastructure Services, 1)istribution **Security Service**



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Infrastructure Services Distribution

Systems Management Service

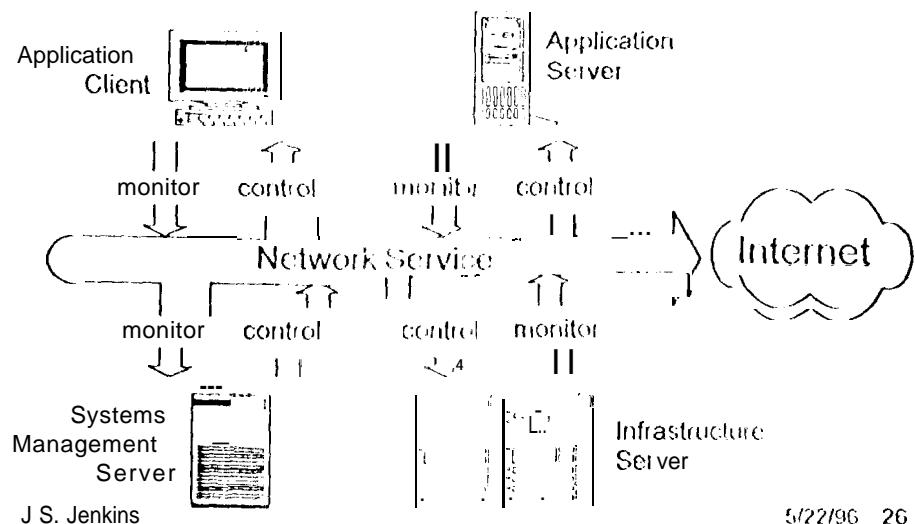
- ◆ Service: Integrated, high-quality, cost-effective management and operation of information system elements
- ◆ Recommendation: SNMP-based commercial technology
- ◆ Status: Prototype development in CAE Project (EPIC) in FY96
 - major engineering and deployment work required

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Infrastructure Services: Distribution

Systems Management Service



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[Infrastructure Services: Application]

File Service

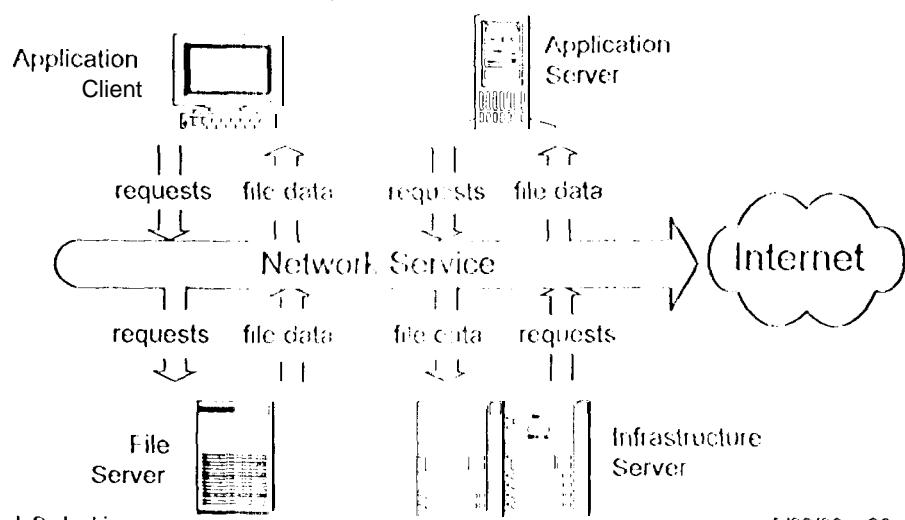
- ◆ Service: Lab wide data sharing using distributed file system technology
- ◆ Recommendation: DCE Distributed File System
- ◆ Status: Engineering 1001 Service (CAE, EPIC) operational now using predecessor technology (AFS); DFS planning under way, complete FY96

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[Infrastructure Services: Application]

File Service



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Infrastructure Services: Application

Messaging Service

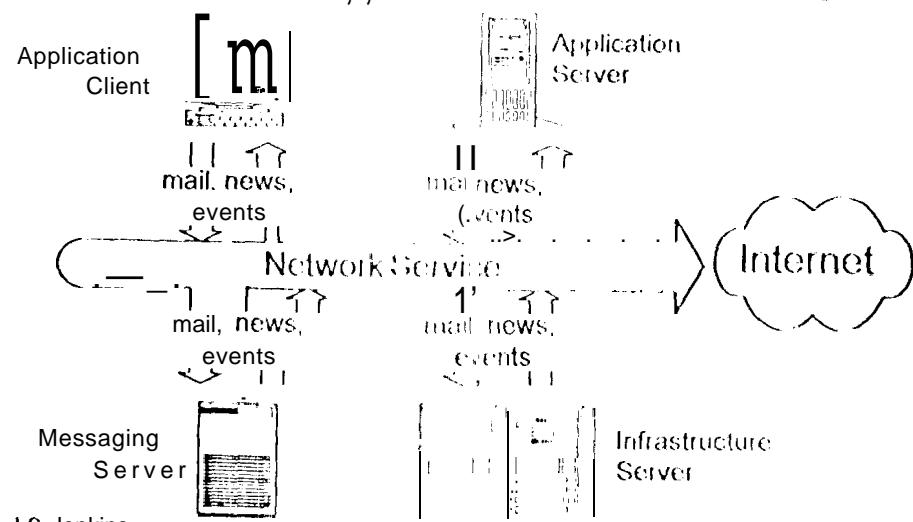
- ◆ Service: Electronic mail, bulletin board, and real-time notification services
- ◆ Recommendation: Internet
SMTP/MIME/POP/IMAP, NNTP, IRC
- ◆ Status: Email implementation beginning (ICIS), complete FY97;
bulletin boards [partially functions] now
(ICIS); notification not planned
 - significant integration work required

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Infrastructure Services: Application

Messaging Service



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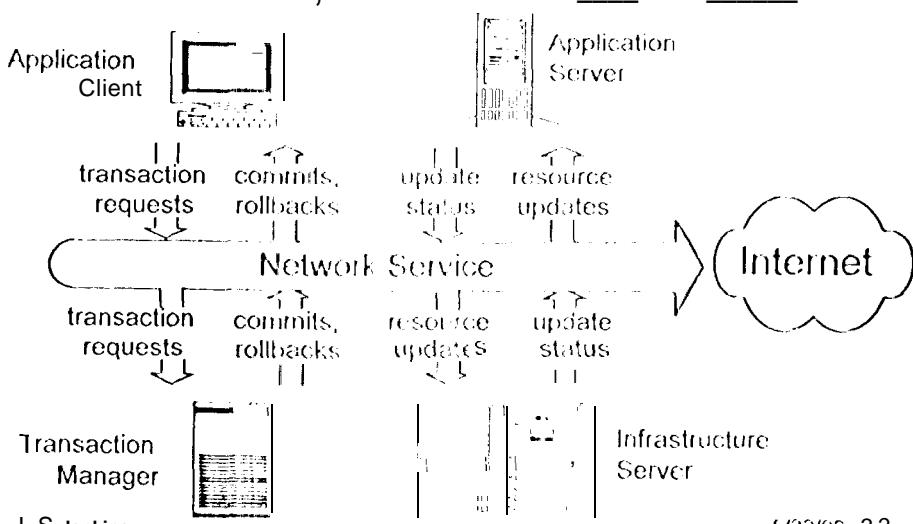
Infrastructure Services: Application Transaction Processing Service

- ◆ Service: Central synchronization mechanism to ensure consistent management of distributed databases
- ◆ Recommendation: X/Open transaction processing specifications
- ◆ Status: No implementation planned; no pressing need currently identified
 - potential uses in TMOD, SESPD, IBS

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Infrastructure Services: Application Transaction Processing Service



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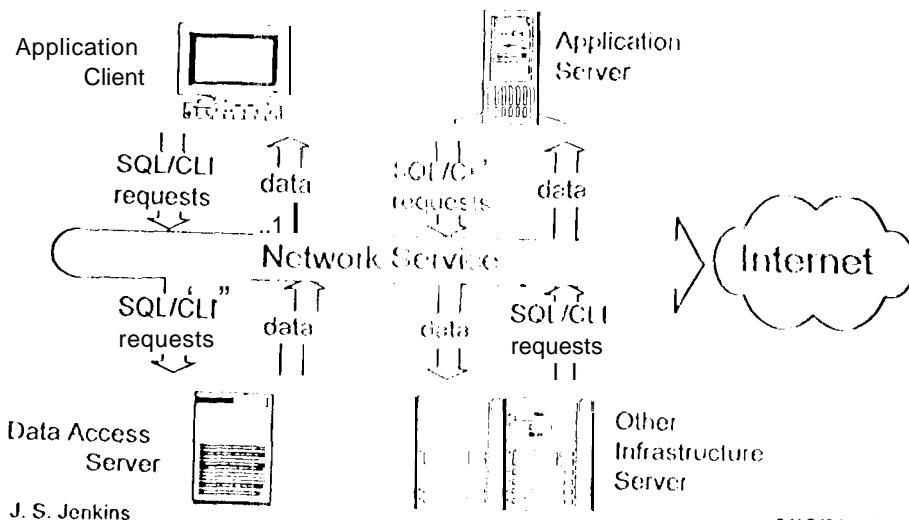
Infrastructure Services: Application **Data Access Service**

- ◆ Service: Access to structured data (i.e., database) in a distributed environment
- ◆ Recommendation: X/Open ISAM, SQL, CLI specifications
- ◆ Status: Engineering Data Service (CAE, EPIC) deploying Oracle-based SQL server, development complete FY96
 - significant integration work required

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Infrastructure Services Application **Data Access Service**



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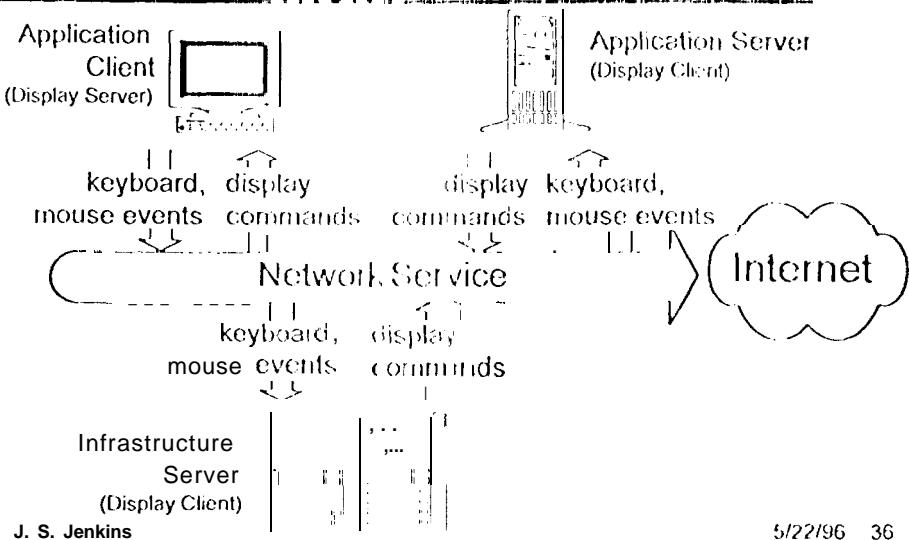
Infrastructure Services: Application Windowing Service

- ◆ Service: Recommended conventions and software for *distributed display* style of client/server computing
- ◆ Recommendation: X Window System Version 11, Release 5
- ◆ Status: X11R5 in wide use now
 - MS Windows and Macintosh are outside service scope (not distributed display model)

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Infrastructure Services: Application Windowing Service



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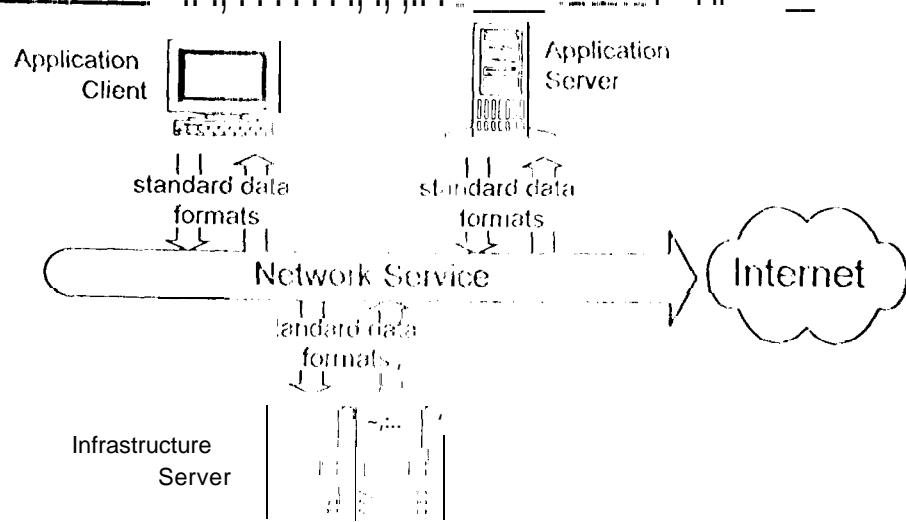
Infrastructure Services: Application **Data Interchange Service**

- ◆ Service: Recommended practices and software for interchange of engineering design, graphics, documents, other data
- ◆ Recommendation: EDIF, IGES, CALS, SGML, HyTime, STEP
- ◆ Status: Multiple *ad hoc* efforts
 - major work required for reengineering

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Infrastructure Services: Application **Data Interchange Service**



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Infrastructure Services: Development support Software Development Framework

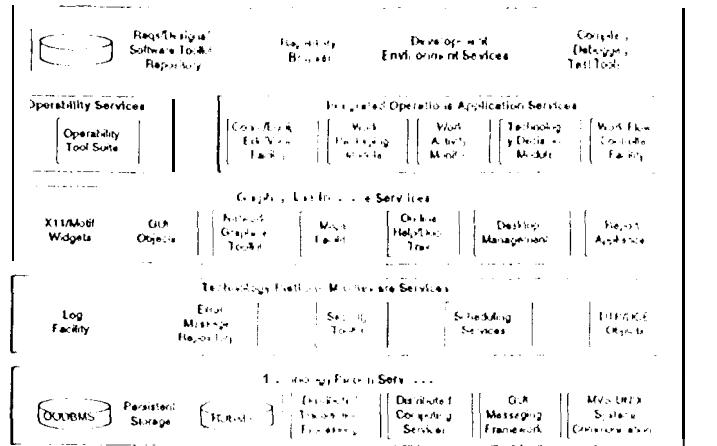
- ◆ Service: Recommended practices and tools for software development
- ◆ Recommendation: None
- ◆ Status: Major work needed to survey requirements and current technology; investment in common tool set lab-wide could yield large returns

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Infrastructure Services: Development Support Software Development Framework

Bellcore's Workstation Software Factory

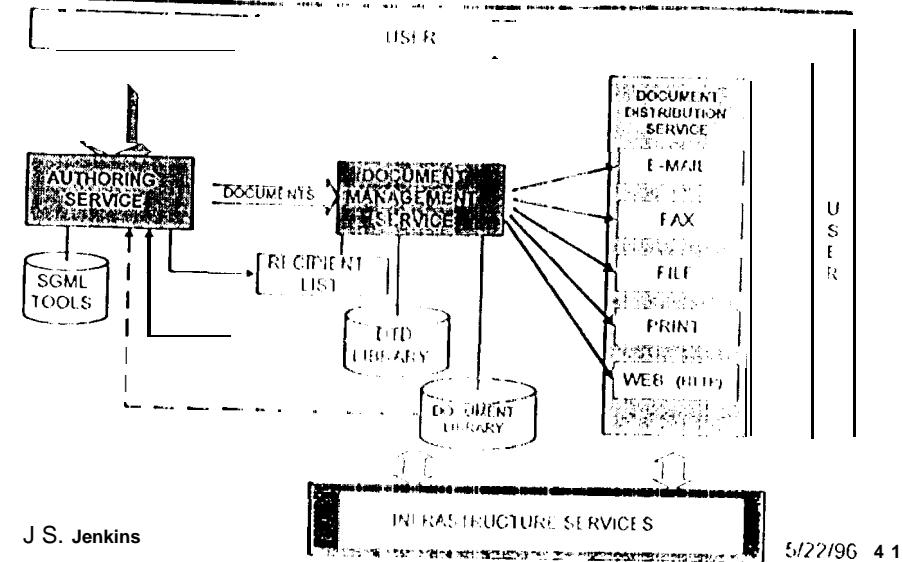


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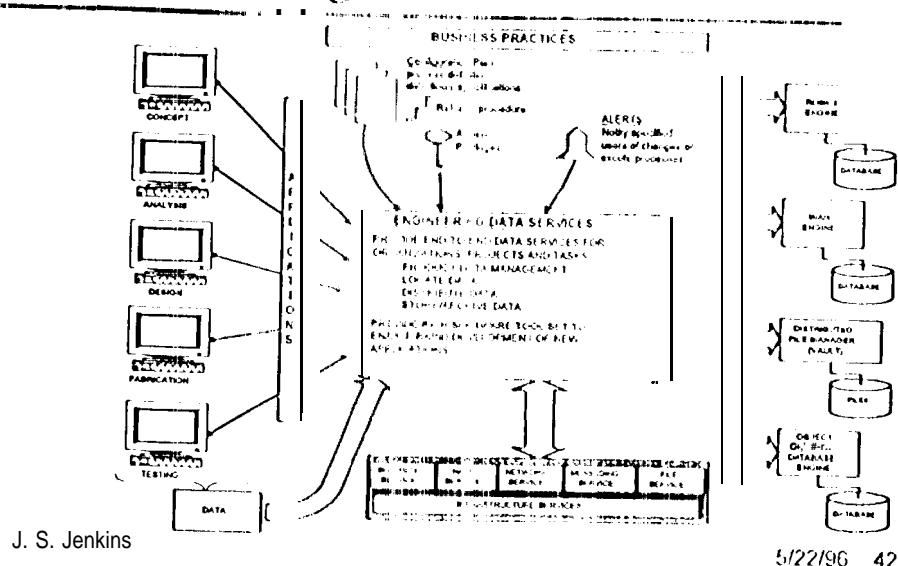
Value-Added Service Example

Electronic Publication Service



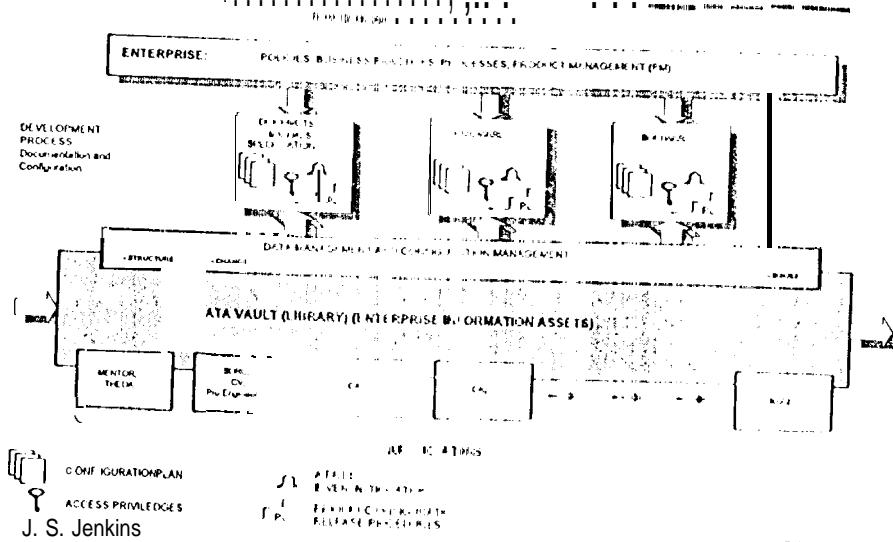
Value-Added Service Example

Engineering Data Service



Value-Added Service Example

Engineering Data Service



Value-Added Service Example

Engineering Data Service

